

Claims

1. A thermoplastic composite sheet comprising:

a center layer made of a thermoplastic composite material containing thermoplastic resin;

and

a continuous reinforcing fiber-impregnated prepreg layer laminated on at least one surface of the upper surface and lower surface of the center layer, the prepreg layer comprising 5-65% by weight of reinforcing fibers and 35-95% by weight of thermoplastic resin.

2. The thermoplastic composite sheet of Claim 1, wherein the center layer comprises 5-50% by weight of reinforcing fibers with an average length of 1-30 mm.

3. The thermoplastic composite sheet of Claim 1, wherein the center layer comprises 15-30% by weight of inorganic filler.

4. The thermoplastic composite sheet of Claim 1, wherein the center layer comprises at least one of 20-40% by weight of wood flour and chaff.

5. The thermoplastic composite sheet of Claim 1, which further comprises a protective layer melted and adhered on the continuous reinforcing fiber-impregnated prepreg layer, the protective layer comprising 0-54% by weight of reinforcing fiber and 46-100% by weight of thermoplastic resin.
6. The thermoplastic composite sheet of Claim 1, wherein the center layer of thermoplastic composite material is a foaming layer or a glass fiber-reinforced thermoplastic resin layer.
7. The thermoplastic composite sheet of Claim 1, wherein the thermoplastic resin is selected from the group consisting of polypropylene, polyethylene, polyamide, polyester, and polyphenylene sulfide resins, and a mixture thereof.
8. The thermoplastic composite sheet of Claim 2, wherein the reinforcing fibers are selected from the group consisting of glass fibers, aramid fibers, natural fibers, polyester fibers, polyamide fibers, and a mixture thereof.

9. The thermoplastic composite sheet of Claim 3, wherein the inorganic filler is selected from the group consisting of calcium carbonate, hollow beads, talc, mica, wollastonite, zinc sulfide, activated carbon, and a mixture thereof.

10. The thermoplastic composite sheet of Claim 1, wherein the continuous reinforcing fiber-impregnated prepreg layer has a bi-directional or mono-directional structure.

11. A method for manufacturing a thermoplastic composite sheet, the method comprising the steps of:

(i) melt-extruding a thermoplastic composite material comprising thermoplastic resin to prepare a center layer made of the thermoplastic composite material;

(ii) providing a continuous reinforcing fiber-impregnated prepreg layer comprising 5-65% by weight of reinforcing fibers and 35-95% by weight of thermoplastic resin and compressing the prepreg layer on at least one surface of the center layer.

12. The method of Claim 11, wherein the center layer comprises 5-50% by weight of reinforcing fibers with an average length of 1-30 mm.

13. The method of Claim 11, wherein the center layer comprises 15-30% by weight of inorganic filler.

14. The method of Claim 11, wherein the center layer comprises at least one of 20-40% by weight of wood flour and chaff.

15. The method of Claim 11, which further comprises the step of: (iii) melt-extruding a mixture of 0-54% by weight of reinforcing fiber and 46-100% by weight of thermoplastic resin onto the continuous reinforcing fiber-impregnated prepreg layer so as to form a protective layer on the prepreg layer.

16. The method of Claim 11, wherein the center layer of thermoplastic composite material is a foaming layer or a glass fiber-reinforced thermoplastic resin layer.

17. The method of Claim 11, wherein the thermoplastic resin is wherein the thermoplastic resin is selected from the group consisting of polypropylene, polyethylene, polyamide, polyester, and polyphenylene sulfide resins, and a mixture thereof.

18. The thermoplastic composite sheet of Claim 12, wherein the reinforcing fibers are selected from the group consisting of glass fibers, aramid fibers, natural fibers, polyester fibers, polyamide fibers, and a mixture thereof.

19. The thermoplastic composite sheet of Claim 13, wherein the inorganic filler is selected from the group consisting of calcium carbonate, hollow beads, talc, mica, wollastonite, zinc sulfide and activated carbon.

20. The thermoplastic composite sheet of Claim 11, wherein the continuous reinforcing fiber-impregnated prepreg layer has a bi-directional or mono-directional structure.

21. An article manufactured by molding a thermoplastic composite sheet manufactured according to Claim 1 into the desired shape in a molding machine together with pellets comprising 10-60% by weight of strength-reinforcing material and 40-90% by weight of thermoplastic resin.
22. The article of Claim 21, wherein the thermoplastic composite sheet is placed in the molding machine after preformed into the desired shape.
23. The article of Claim 21, wherein the strength-reinforcing material is a reinforcing fiber with a length of less than 30 mm, which is selected from the group consisting of glass fiber, aramid fiber, natural fiber, polyester fiber, polyamide fiber and a mixture thereof.
24. The article of Claim 21, wherein the strength-reinforcing material is selected the group consisting of calcium carbonate, hollow beads, talc, mica, wollastonite, zinc sulfide, activated carbon, and a mixture thereof.
25. The article of Claim 21, wherein the thermoplastic composite sheet is partially drilled or slitted.

26. The article of Claim 21, which is molded by a low-pressure injector.



27. An article manufactured by heat-melting a thermoplastic composite sheet manufactured according to Claim 1 and then press-molding the heated material in a mold at a lower temperature than the melting point thereof.

28. An article manufactured by molding a continuous reinforcing fiber-impregnated prepreg layer comprising 5-65% by weight of reinforcing fibers and 35-95% by weight of thermoplastic resin into the desired shape in a molding machine together with pellets comprising 10-60% by weight of strength-reinforcing material and 40-90% by weight of thermoplastic resin.

29. The article of Claim 28, wherein the thermoplastic composite sheet is placed in the molding machine after preformed into the desired shape.

30. The article of Claim 28, wherein the strength-reinforcing material is a reinforcing fiber with a length of less than 30 mm, which is selected from the group consisting of glass fiber, aramid fiber, natural fiber, polyester fiber, polyamide fiber and a mixture thereof.

31. The article of Claim 28, wherein the strength-reinforcing material is selected the group consisting of calcium carbonate, hollow beads, talc, mica, wollastonite, zinc sulfide, activated carbon, and a mixture thereof.

32. The article of Claim 28, wherein the continuous reinforcing fiber-impregnated prepreg layer is molded in combination with a glass mat thermoplastic sheet into the desired shape in a molding machine.

33. The article of Claim 28, wherein the continuous reinforcing fiber-impregnated prepreg layer is partially drilled or slitted.

34. The article of Claim 27, wherein the thermoplastic composite sheet is molded in combination with a glass mat thermoplastic sheet into the desired shape in a molding machine.

35. The article of Claim 21, which is a building panel.

36. The article of Claim 27, which is a building panel.

37. The article of Claim 28, which is a building panel.

38. The article of Claim 22, which is an automobile bumper back beam.

39. The article of Claim 29, which is an automobile bumper back beam.